US006295423B1

(12) **United States Patent**
Haines et al.

(10) **Patent No.: US 6,295,423 B1**
(45) **Date of Patent: Sep. 25, 2001**

(54) **METHODS AND SYSTEMS FOR MONITORING CONSUMABLE ITEM LIFETIMES FOR PERIPHERAL UNITS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/480,543**

(22) Filed: **Jan. 10, 2000**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/410,989, filed on Oct. 1, 1999.

(51) **Int. Cl.**[7] **G03G 21/00**
(52) **U.S. Cl.** **399/24**; 399/9
(58) **Field of Search** 399/24–29, 9, 399/11, 43

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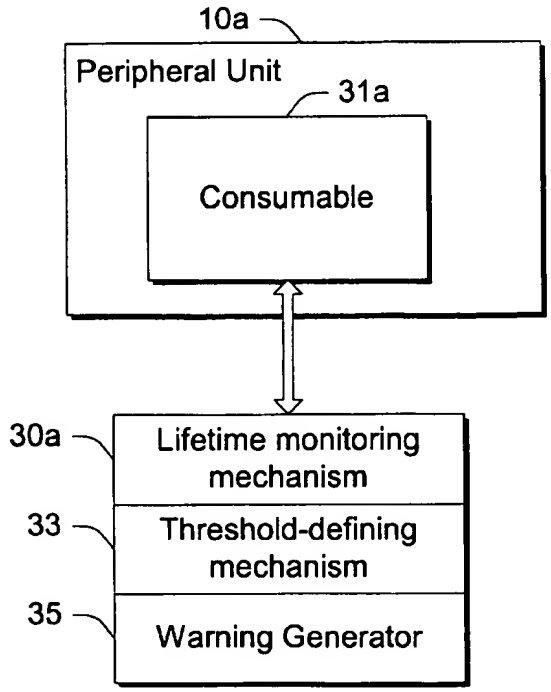
Primary Examiner—Quana M. Grainger

(57) **ABSTRACT**

Methods and apparatus for generating notifications associated with the lifetime of peripheral unit consumables are described. In the described embodiments, users or clients are able to define and adjust their own threshold values that are associated with a consumable's lifetime. In one embodiment, a lifetime monitoring mechanism is provided and monitors the lifetime of a peripheral unit consumable that is associated with operation of the peripheral unit. The lifetime monitoring mechanism is configured with a user-manipulable, threshold-defining mechanism that is configured to receive user input and, responsive to the user input, define a threshold value for the lifetime monitoring mechanism. The peripheral unit's use of the consumable is monitored using the lifetime monitoring mechanism. A determination is made when the peripheral unit's use of the consumable reaches the threshold value and, responsive thereto, a notification is generated.

20 Claims, 4 Drawing Sheets



US-PAT-NO: 6295423

DOCUMENT-IDENTIFIER: US 6295423 B1

TITLE: Methods and systems for monitoring consumable item lifetimes for peripheral units

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Detailed Description Text - DETX (4):

FIG. 1 shows a peripheral unit in the form of an electrophotographic printing device, or printer, 10 for depositing laser generated images onto a piece of paper. Laser printer 10 is shown in a multiple user or client configuration wherein several computers 12, 14 and 16 are connected with printer 10 via an array of connections in the form of a network bus 18 of a computer network environment 20. In the context of this document, the terms "user" and "client" will be understood to include, without limitation, a computer or a human user or client. As shown, computer network environment 20
is in the form of a local area network, although any network environment, e.g. the **internet,** can be used. Any one of computers 12, 14 and 16 can send a print job to printer 10 with each printer having a printer driver (not shown) for 10 formatting a print job for delivery to printer 10.

Detailed Description Text - DETX (14):

The description given just below is intended as a high level description of the operation of a laser printer that can be used in accordance with the described embodiment. According to the laser printer implementation, an electrophotographic printer utilizes a solid-state laser which scans across and exposes a photoconductor drum creating a latent image on the photoconductor drum. Subsequently, a powder toner cartridge deposits toner along the latent image of the drum. A toner cartridge of printer 10 delivers electrostatically charged powder toner particles (either black or colored) to a charged latent image on a photoconductor surface of a photoconductor drum, developing the photoconductor where the particles selectively adhere to appropriately charged regions. A charging corona, or optionally a charge transfer roller, charges the back side of a paper such that toner is transferred from the photoconductor drum to the paper where the paper and drum contact in the region of the charging corona. Subsequently, a fusing station thermally fuses the

transferred powder toner to the paper. Finally, a cleaning station cleans any residual toner from the surface of photoconductor drum, enabling reinitiation of the cycle beginning with a process initiation point. Especially for the case of mono component development as **used** in low end printers, a **toner cartridge** forms a replaceable toner/developer cartridge which enables a user to replace **toner when the cartridge** has been emptied. The cartridge enables relatively quick and easy toner replacement by a user. Such a replaceable toner cartridge for use in a printer includes a cartridge housing typically formed from plastic material. A separate memory can be provided on the **toner cartridge** for temporarily, or even permanently, storing information about toner levels detected by the sensor, as spell as pixel count information **used** to describe print job characteristics of users. A toner supply reservoir is formed within the housing where a supply of powdered toner is stored for later use. A metering blade co-acts Wraith a developer roll to deliver a metered amount of powdered toner along a developer roll where it is transferred to the surface of the photoconductor drum alone charged regions. The developer roll preferably comprises a rotating toner/development roll having appropriate charging properties that are employed to charge the toner by way of touch and rubbing contacts. Accordingly, the toner electrostatically adheres to the roll along which it is transported to contact the photoconductor drum at the nip of the drum and roll. Optionally, the toner/development roll is separated from the photoconductor drum by a gap, the toner jumping the gap via charge jumping to transfer to the drum. In the presence of a charge-biased development field, delivered toner is selectively transferred to those areas of the photoconductor drum having an opposite sign charge.

Detailed Description Text - DETX (24):

In this example, printer 10 includes a processor 36, memory 38/42, an experiential database 48, an artificial intelligence model 50, and user print job characteristics 46. These components arc arranged to provide a pixel counting function that provides a way of determining when toner might be low. User print job characteristics 46 comprise print job characteristics compiled from previous print jobs and/or user experiential print job data. Experiential database 48 is compiled over a period of use and time by users and/or computers
indicating the print job characteristics for each user and/or computer. Experiential database 48 can contain historical information about the number of pixels **used** per page of printed text/graphics as compiled from each print job implemented during a particular **toner cartridge's** lifetime. Even further, usage from previous **toner cartridges** can also be **used** to collect such historical information. Such experiential data can then be **used** to make projections about how much toner will be **used** during a remaining portion of capacity, or life, of a **toner cartridge**. For example, information about

particular print jobs can be correlated with the source of the job in order to make predictions, and/or define trends, that predict the level of toner that will be needed to print jobs that will later be received from that particular job source during use of the remaining lifetime of a toner cartridge.

Detailed Description Text - DETX (27):

Artificial intelligence model 50, in another simplified implementation, can be formed as a set of simple algebraic equations that combine the toner use trends for each print job and/or user in the experiential database. For example, the average number of pixels **used** per par,e from print jobs emanating from a particular user or computer (e.g. computers 12, 14, 16 in FIG. 1) can be monitored during the lifetime of a **toner cartridge**. Model 50 can then note the frequency with which print jobs are received from this particular user, and predict the frequency of use by the user during the remaining portion of cartridge use. The information learned from that user's print job characteristics 46, as collected in database 48 during a first portion of use, as well as other user's print job characteristics, are then combined in the artificial intelligence model 50 to enable a more accurate prediction of toner use during a last portion of cartridge use. For example predictions can be made base on future print jobs based upon knowledge of which users print which type of job during a weekly, and/or hourly work schedule, then correlating the associated pixel user based on characterization of the print jobs submitted by the user to the printer. With such information having been collected and processed, the model 50 can monitor the predicted lifetime of the consumable item and generate the appropriate notification when the user-defined threshold value is reached.